Geotechnical Engineering Report

Outpatient Services Expansion
VA Medical Center
Tuscaloosa, Alabama

November 14, 2014
Terracon Project No: E1145217

Prepared for:
Toland Mizell Molnar
Atlanta, Georgia

Prepared by:
Terracon Consultants, Inc.
Birmingham, Alabama

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November 14, 2014

Toland Mizell Molnar
590 Means Street NW
Suite 200
Atlanta, Georgia 30318

Attn: Mr. Dan McTier
Architect
P: [404] 214 9774
E: DMcTier@Toland-Mizell-Molnar.com

Re: Geotechnical Engineering Report
Outpatient Services Expansion
VA Medical Center
Tuscaloosa, Alabama
Terracon Project Number: E1145217

Dear Mr. McTier:

Terracon has completed the geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal PE1140716 dated September 16, 2014. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project. This report also includes seismic site classification based on surface seismic testing using the SeisOpt®ReMi™ method.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Christopher L. Roberts, P.E.
Senior Project Engineer
Registration PE 26344

David A. Beech, P.E.
Senior Consultant
Registration PE 17306

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EXECUTIVE SUMMARY

This geotechnical exploration has been performed for the Building 38 outpatient services expansion at the VA Medical Center campus in Tuscaloosa, Alabama. Six (6) borings were performed to depths of approximately 30 feet below the existing ground surface. Exhibit A-2 shows the approximate location of each boring. The following geotechnical considerations were identified:

- The proposed building may be supported on shallow foundations bearing on stiff or better existing native soils. The test borings indicated that the stiff or better soils were encountered at depths of 2-1/2 to 5 feet below existing ground surface (bgs).

- Conventional shallow foundations (spread footings) bearing on stiff or better native soils may be designed using a net allowable bearing pressure of 3,000 psf. The maximum allowable soil bearing pressure may be increased by 25 percent for non-sustained transient loads such as wind.

- In the event that higher bearing capacities are required (than provided when using conventional shallow foundation systems for building support), the structure may be brought to bear on a series of rammed aggregate stone columns or auger cast piles. We can discuss these options with you at your convenience. Further site exploration in the form of deeper soil borings would be required to evaluate auger cast pile foundations. Compacted stone column foundation systems would reinforce the existing subsoils on the site and allow shallow foundation support of the structural loads of the buildings. This alternative allows for a significantly higher design bearing pressure for footing design while controlling total and differential settlements by modifying the ground response parameters of the composite soil mass below the footings. We suggest that you contact Geopier or Hayward Baker regarding this foundation alternative.

- Assuming proper site preparation, total and differential settlement should be within anticipated client/owner specifications.

- The 2009 International Building Code (IBC), Table 1613.5.2 seismic site classification for this site is C.

- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
OUTPATIENT SERVICES EXPANSION
VA MEDICAL CENTER
TUSCALOOSA, ALABAMA

Terracon Project No: E1145217
November 14, 2014

1.0 INTRODUCTION

This geotechnical exploration has been performed for the proposed Outpatient Services Expansion (Building 38) on the VA Medical Center campus in Tuscaloosa, Alabama. The field exploration consisted of performing six (6) Standard Penetration Test borings.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- foundation design and construction
- IBC seismic site classification
- floor slab design and construction
- earthwork

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Structures	Multi-story additions infilling existing courtyards. We anticipate five (5) stories with the first floor partially below grade to match the finish floor elevation of the existing structure.
Building Construction	Metal framed, brick-veneer with concrete slab-on-grade construction anticipated
Finished floor elevation	Unknown at the time of this report – assumed to match existing Building 38 elevations
Maximum loads	2 kips per foot for load bearing walls (per structural engineer) 200 kips interior/150 kips exterior column loads (per structural engineer) Less than 150 psf for maximum uniform slab-on-grade loads (assumed)

ITEM	DESCRIPTION
Grading	Based on current site grades, we anticipate cuts of up to about 5 feet to establish finish site grades.
Below grade areas	Partial below grade first floor to match existing building elevations
Slopes	None anticipated

Should any of the above information or assumptions be inconsistent with the planned construction, please let us know so that we may make any necessary modifications to this report.

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	VA Medical Campus in Tuscaloosa, Alabama; see Exhibit A-1
Existing improvements	The site is currently used as courtyards for Building 38. The site contains several underground utilities.
Current ground cover	Grass, bare soil, landscaped areas, concrete sidewalks
Existing topography	Gently sloping up to the north/northeast

3.0 SUBSURFACE CONDITIONS

3.1 Geology

Published maps from the Geological Survey of Alabama and a review of the geology of Tuscaloosa County, Alabama indicate that the area is underlain by the Pleistocene age High Terrace Deposits. The High Terrace Deposits consist of varicolored lenticular beds of poorly sorted sand, ferruginous sand, silt, clay, and gravelly sand. Sand consists primarily of very fine to very coarse poorly sorted quartz grains; gravel composed of quartz, quartzite, and chert pebbles.

3.2 Typical Profile

The approximate locations of our borings are indicated on the accompanying Exhibit A-2, Boring Location Plan, in Appendix A. The borings typically encountered about 2 to 5 inches of topsoil followed by about 2-1/2 feet of lean clay fill. Next, the borings typically encountered lean clay (CL) with varying amounts of sand and sandy lean clay (CL) to depths of roughly 23 to 28-1/2 feet below existing grades. The encountered clay was typically medium stiff to a depth of about 5 feet; becoming stiff to hard below 5 feet. “N” values generally ranged between 7 and 30. However, soft native lean clay (CL) with an “N” value of 4 was disclosed in boring B-4 from a depth of roughly 2-1/2 to 5 feet below existing grade. Following the clay strata, the borings encountered sand (SP) to boring termination depths of roughly 30 feet below existing grades. The sandy soils typically were of a loose to medium dense relative density with “N” values between 7 and 29.

A sample of the subgrade soils was tested for Atterberg limits. The following table indicates the results of the Atterberg limits testing.

Sample Location, Depth	Soil Type	Liquid Limit	Plastic Limit	Plasticity Index
Boring B-3, 2.5-4.0 ft.	Native	42	18	24

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A.

3.3 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was not observed in any of the borings while drilling, or for the short duration (approximately 24 hours) that the borings were allowed to remain open. However, this does not necessarily mean the borings terminated above groundwater. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Development of this site will require demolition of sidewalks, removal of structures within the planned construction area, and stripping and grubbing of topsoil and existing vegetation, including the rootballs of existing trees. Following proper site preparation, the proposed structure can be supported on a conventional shallow foundation system. In the event that higher bearing capacities are required (than provided when using conventional shallow foundation systems for building support), the structure may be brought to bear on a series of rammed aggregate stone columns or auger cast piles. We can discuss these options with you at your convenience. Further site exploration in the form of deeper soil borings would be required to evaluate auger cast pile foundations. Compacted stone column foundation systems would reinforce the existing subsoils on the site and allow shallow foundation support of the structural loads of the buildings. This alternative allows for a significantly higher design bearing pressure for footing design while controlling total and differential settlements by modifying the ground response parameters of the composite soil mass below the footings. We suggest that you contact Geopier or Hayward Baker regarding this foundation alternative.

We recommend that the exposed subgrade be thoroughly evaluated after stripping of topsoil and creation of all cut areas, but prior to the start of fill operations (if any). We recommend that the geotechnical engineer be retained to evaluate the bearing material for the foundations and floor slab subgrade soils. Subsurface conditions, as identified by the field and laboratory testing programs, have been reviewed and evaluated with respect to the proposed building plans known to us at this time.

4.2 Earthwork

4.2.1 Site Preparation

Prior to placing any fill, all vegetation, topsoil, and any otherwise unsuitable material should be removed from the construction areas. Wet or dry material should either be removed or moisture conditioned and recompacted. After stripping and grubbing, the subgrade should be proof-rolled where possible to aid in locating any loose or soft areas. Proof-rolling can be performed with a loaded tandem axle dump truck. Soft, dry and low-density soil should be removed or compacted in place prior to placing fill.

The site was previously graded and developed in the past. Borings indicate that about 2-1/2 feet of existing fill is present across the planned construction area. Much of this fill be removed to achieve the planned finish grades. However, any remaining fill should be thoroughly evaluated by the geotechnical engineer. Unsuitable fil material should be undercut and replaced with engineered fill. We caution that burn pits, burial pits, organic debris, construction debris or other deleterious materials could exist across the site, between or away from our borings. Debris fill may not become evident until construction. Any deleterious materials, if observed should be removed and replaced with new, well-compacted engineered fill.

Following any necessary undercut, fill may be placed and compacted as required to obtain planned finish subgrade elevations.

4.2.2 Structural Fill Material Requirements

Structural fill should meet the following material property requirements:

FILL TYPE [1]	USCS CLASSIFICATION	ACCEPTABLE LOCATION FOR PLACEMENT
Lean clay	CL (LL<50 and PI<25)	All locations and elevations
Silt	ML (LL<50 and PI<25)	All locations and elevations
Sand	SW, SC, SM	All locations and elevations

FILL TYPE [1]	USCS CLASSIFICATION	ACCEPTABLE LOCATION FOR PLACEMENT
On-Site Soils	Varies	The on-site soils which are not organic laden appear suitable for reuse as fill following proper moisture conditioning.

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.

4.2.3 Structural Fill Placement and Compaction Requirements

ITEM	DESCRIPTION
Fill Lift Thickness	8-inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements [1]	At least 98% of the material's maximum standard Proctor dry density (ASTM D 698)
Moisture Content for Cohesive Soil	Within 2 percentage points of the optimum moisture content value as determined by the standard Proctor test at the time of placement and compaction
Moisture Content for Granular Material [2]	Workable moisture levels

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.2.4 Grading and Drainage

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters and downspouts that drain water a minimum of 5 feet beyond the footprint of the proposed structure are recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

4.2.5 Earthwork Construction Considerations

Areas of unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of slabs-on-grade. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. Temporary excavations should also be designed to prevent undermining or loss of support of adjacent building foundations and floor slabs. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during construction to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

4.3 Conventional Shallow Foundations

In our opinion, the proposed structure can be supported by shallow, spread footing foundation systems bearing on stiff or better native soils. Borings indicate that these soils are generally located at a depth of about 2-1/2 to 5 feet below existing site grades. Design recommendations for shallow foundations for the proposed structure are presented in the following paragraphs.

4.3.1 Design Recommendations

DESCRIPTION	COLUMNS	WALLS
Net allowable bearing pressure [1] **(Native stiff or better leans clays)**	3,000 psf	3,000 psf
Minimum dimensions	36 inches	24 inches
Minimum embedment below finished grade	18 inches	18 inches
Approximate total settlement	1 inch	1 inch
Estimated differential settlement	<3/4 inch between columns	<3/4 inch over 40 feet
Passive pressure equivalent fluid pressure [2]	330 pcf	

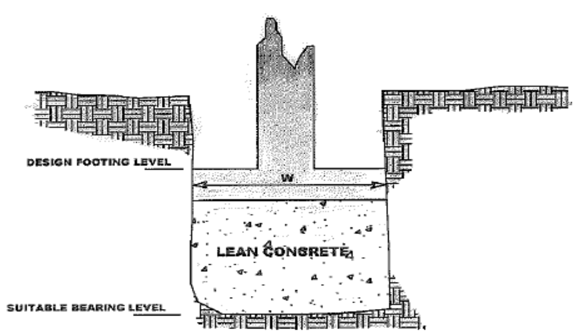
Ultimate coefficient of sliding friction [2]	0.35

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes that unsuitable fill or soft soils will be undercut and replaced with engineered fill.
2. The sides of the excavation for the spread footing foundation must be nearly vertical and the concrete should be placed neat against these vertical faces for the passive earth pressure value to be valid. If the loaded side is sloped or benched, and then backfilled, the allowable passive pressure will be significantly reduced. Passive resistance in the upper 18 inches of the soil profile should be neglected. If passive resistance is used to resist lateral loads, the base friction should be neglected.

4.3.2 Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil and rock prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, or frozen, the affected soil should be removed prior to placing concrete. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

If unsuitable bearing soils are encountered in foundation excavations, the excavation should be extended deeper to suitable soils. The foundation could bear directly on the soils at the lower level or on lean concrete backfill placed in the excavations. The overexcavation and backfill procedure is described in the following figure.



LEAN CONCRETE BACKFILL

NOTE: Excavation in sketch shown vertical for convenience. Excavations should be sloped as necessary for safety.

We recommend all excavations be sloped, shored, or braced to maintain stability. Excavations must be constructed in accordance with all local, state, and federal requirements including OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, as well as other applicable codes. The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the sides and bottom of the excavation. Contractors should take care not to undermine existing footings.

4.4 Seismic Considerations

To evaluate the seismic site classification based on shear-wave velocities, Terracon conducted three (3) seismic survey lines designated as seismic array A-A', seismic array B-B', and seismic array C-C' on the subject site using a refraction micro-tremor (ReMi) method. The locations of the seismic survey lines are represented on the attached Exhibit A-10. A shear-wave velocity seismic survey is effective in characterizing the shear-wave velocities at various depths in the subsurface, which can be correlated to relative soil densities. Relatively higher shear-wave velocities indicate very stiff soil and/or bedrock, and relatively lower shear-wave velocities indicate soft and/or medium soils. Along each seismic survey, a subsurface cross-sectional profile was constructed which show seismic-velocities correlated with depth along the seismic survey lines (Exhibits A-11, A-12, A-13). Based on the average, weighted, shear-wave velocity values of the seismic surveys, the seismic site classification was determined using the 2009 IBC Table 1613.5.2.

Using the ReMi geophysical method to measure shear-wave velocities in the upper 100 feet of the subsurface profile, we determined the weighted, average shear-wave velocities for seismic arrays A-A', B-B', and C-C' to be approximately 1,864 feet per second (ft/sec), 2,133 ft/sec, and 1,959 ft/sec, respectively. Based on this data, we have determined that the seismic site classifications based on shear wave velocity, is Site Class 'C'.

4.5 Floor Slab

4.5.1 Floor Slab Design Recommendations

ITEM	DESCRIPTION
Floor slab support	Existing stiff or better native soils or new engineered fill [1]
Modulus of subgrade reaction (K)	125 pci for point loading
Aggregate base course/capillary break [2]	4 inches of free draining granular material

1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of cracking caused by differential movements between the slab and foundation. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moisture conditioned, and recompacted.
2. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates that any differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks that occur beyond the length of the structural dowels. The structural engineer should account for this potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

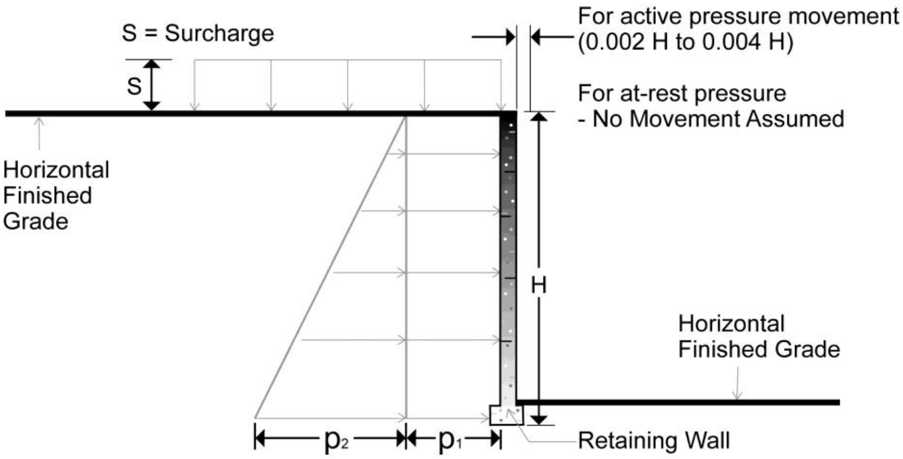
4.5.2 Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of sub-base material and concrete and corrective action will be required.

We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled with a loaded dump truck prior to final grading and placement of the sub-base. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the sub-base and concrete.

4.6 Lateral Earth Pressures

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

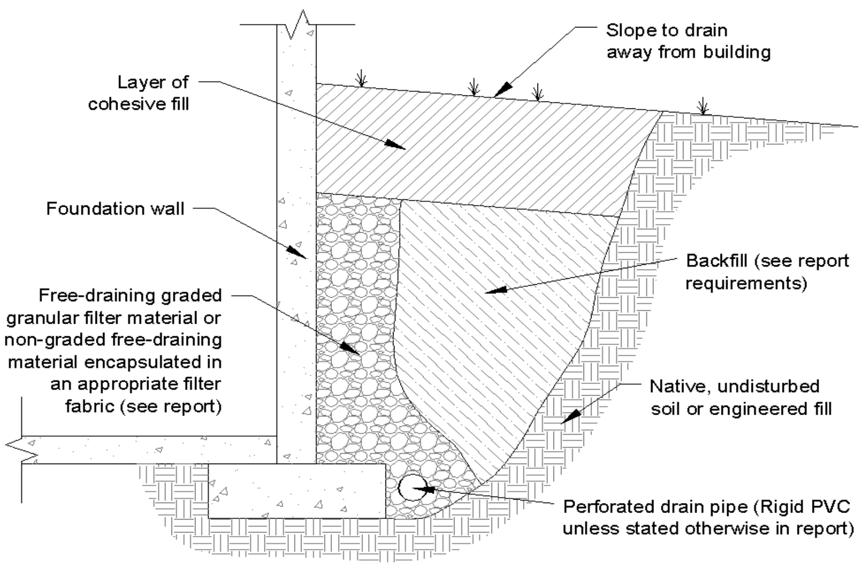
Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Granular - 0.24 Lean Clay - 0.36	26 43	(0.24)S (0.36)S	(26)H (43)H
At-Rest (Ko)	Granular - 0.38 Lean Clay - 0.53	42 64	(0.38)S (0.53)S	(42)H (64)H
Passive (Kp)	Granular – 4.2 Lean Clay - 2.8	462 330	--- ---	--- ---

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill, compacted between 95 and 98 percent of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.35 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

A perforated rigid plastic or metal drain line installed behind the base of walls that extend below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5 percent passing the No. 200 sieve. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

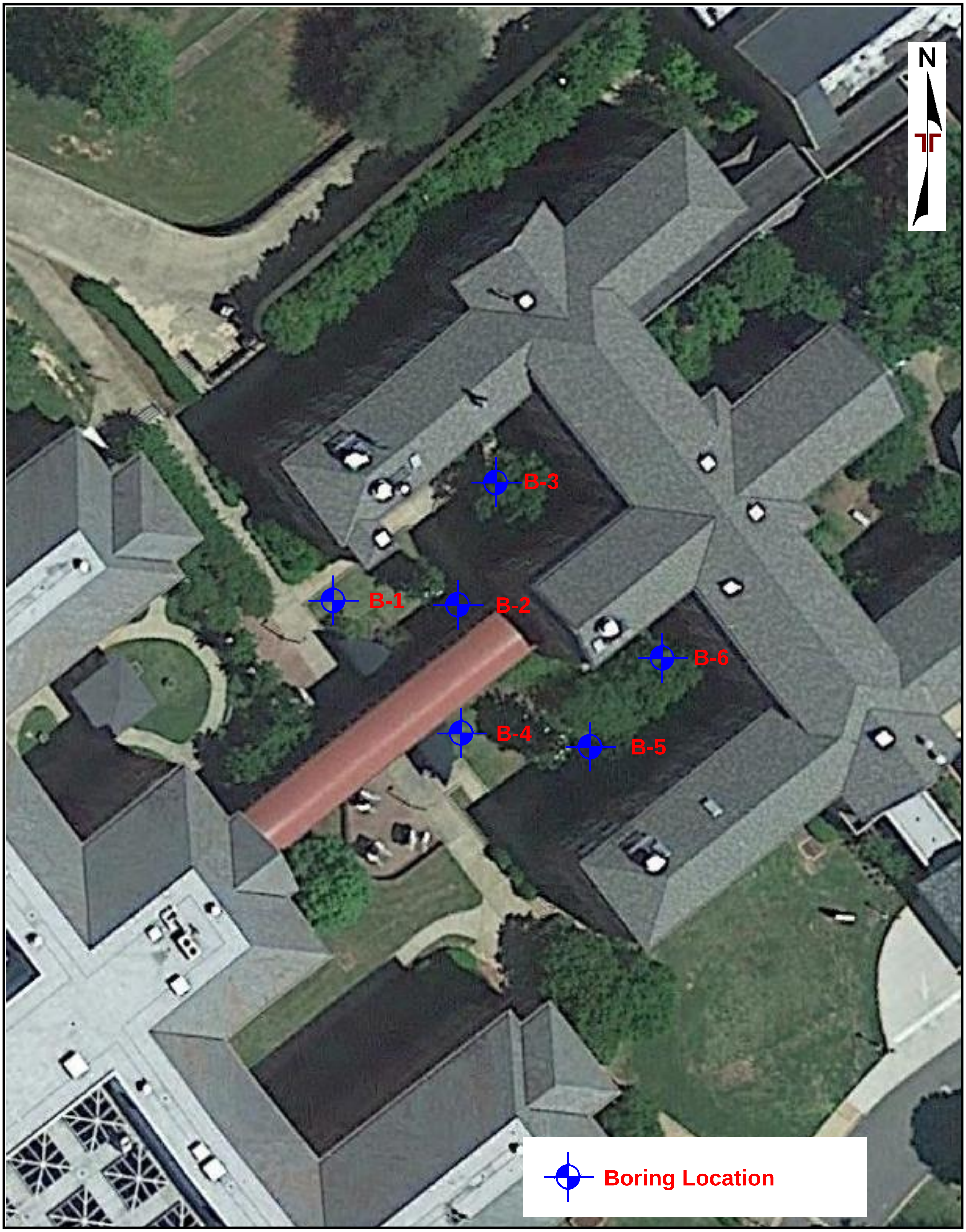
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION

Project Manager: SWW	Project No. E1145217	Terracon Consulting Engineers & Scientists	Site Location Plan	EXHIBIT
Drawn by: SWW	Scale: NTS	110 12th Street North Birmingham, Alabama 35203	Outpatient Services Expansion	A-1
Checked by: CLR	File Name: E1145217 BLP	PH. (205) 942-1289 FAX. (205) 443-5302	VAMC – Tuscaloosa	
Approved by: CLR	Date: 10/27/2014		Tuscaloosa, Alabama	



Project Manager: SWW	Project No. E1145217	Terracon Consulting Engineers & Scientists	Boring Location Plan	EXHIBIT
Drawn by: SWW	Scale: NTS	110 12th Street North, Birmingham, Alabama 35203	Outpatient Services Expansion	A-2
Checked by: CLR	File Name: E1145217 BLP	PH. (205) 942-1289 FAX. (205) 443-5302	VAMC – Tuscaloosa	
Approved by: CLR	Date: 10/27/2014		Tuscaloosa, Alabama	

Field Exploration Description

The boring locations were laid out on the site by the Terracon field staff and were measured from available site features. Right angles for the boring locations were estimated. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a track-mounted Geoproble rotary drill rig configured with an automatic hammer using continuous flight augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split-barrel sampling procedure.

In the split barrel sampling procedure, the number of blows required to advance a standard 2 inch O.D. split barrel sampler the last 12 inches of the typical total 18 inch penetration by means of a 140 pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

A field log of each boring was prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller’s interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation of the samples.

BORING LOG NO. B-1

PROJECT: Outpatient Services Expansion VAMC Tuscaloosa

CLIENT: Toland Mizell Molnar

SITE: Tuscaloosa, Alabama

LOCATION See Exhibit A-2

GRAPHIC LOG DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**TOPSOIL**			X	2-5-5 N=10			
2.5	**LEAN CLAY, FILL**, some sand, brown							
	LEAN CLAY (CL), trace sand, red-brown, medium stiff			X	1-3-4 N=7	20		
		5		X	6-8-11 N=19			
	becomes very stiff							
12.0		10		X	6-9-11 N=20			
18.5	**SANDY LEAN CLAY (CL)**, red-brown, stiff	15		X	4-5-7 N=12	16		
23.5	**SANDY LEAN CLAY (CL)**, red-brown to tan mottled, very stiff	20		X	4-7-11 N=18			
28.5	**SANDY LEAN CLAY (CL)**, tan, very stiff	25		X	4-6-10 N=16			
30.0	**POORLY-GRADED SAND (SP)**, tan, loose	30		X	3-3-4 N=7	10		
	Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Backfilled with cuttings

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No water observed

Terracon
110 12th Street North
Birmingham, Alabama

Boring Started: 10/30/2014	Boring Completed: 10/30/2014
Drill Rig: Geoprobe	Driller: CTL
Project No.: E1145217	Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E1145217 OUTPATIENT SERVICES EXPANSION VAMC TUSCALOOSA.GPJ TEMPLATE UPDATE 3-31-14.GPJ 11/14/14

BORING LOG NO. B-2

PROJECT: Outpatient Services Expansion VAMC Tuscaloosa

CLIENT: Toland Mizell Molnar

SITE: Tuscaloosa, Alabama

LOCATION See Exhibit A-2

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	**TOPSOIL**							
2.5	**LEAN CLAY, FILL**, some sand, red-brown to dark brown				2-3-2 N=5			
	LEAN CLAY (CL), trace sand, red-brown, medium stiff				1-2-5 N=7			
	becomes very stiff	5			3-7-11 N=18	21		
12.0		10			6-8-12 N=20			
18.5	**LEAN CLAY (CL)**, with sand, light red-brown, medium stiff	15			5-6-9 N=15			
23.5	**SANDY LEAN CLAY (CL)**, tan, very stiff	20			7-10-12 N=22			
	POORLY-GRADED SAND (SP), tan, medium dense	25			6-6-5 N=11	13		
30.0	becomes loose	30			3-4-5 N=9			
	Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Backfilled with cuttings

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No water observed

Terracon
110 12th Street North
Birmingham, Alabama

Boring Started: 10/30/2014	Boring Completed: 10/30/2014
Drill Rig: Geoprobe	Driller: CTL
Project No.: E1145217	Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E1145217 OUTPATIENT SERVICES EXPANSION VAMC TUSCALOOSA.GPJ TEMPLATE UPDATE 3-31-14.GPJ 11/14/14

BORING LOG NO. B-3

PROJECT: Outpatient Services Expansion VAMC Tuscaloosa

CLIENT: Toland Mizell Molnar

SITE: **Tuscaloosa, Alabama**

LOCATION See Exhibit A-2

DEPTH	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
0.3	**TOPSOIL**							
2.5	**LEAN CLAY, FILL**, with sand, dark brown to red-brown			X	4-7-6 N=13	16		
5.0	**LEAN CLAY (CL)**, trace sand, red-brown, very stiff			X	6-8-9 N=17		42-18-24	
13.5	**LEAN CLAY (CL)**, with sand, red-brown to tan mottled, very stiff	5		X	6-9-12 N=21			
		10		X	7-10-12 N=22	17		
23.5	**SANDY LEAN CLAY (CL)**, light red-brown to tan, very stiff	15		X	5-8-10 N=18			
		20		X	8-10-12 N=22			
	POORLY-GRADED SAND (SP), light brown, medium dense	25		X	4-5-6 N=11	10		
30.0	becomes loose	30		X	3-4-5 N=9			
	Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Backfilled with cuttings

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No water observed

Terracon
110 12th Street North
Birmingham, Alabama

Boring Started: 10/30/2014	Boring Completed: 10/30/2014
Drill Rig: Geoprobe	Driller: CTL
Project No.: E1145217	Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E1145217 OUTPATIENT SERVICES EXPANSION VAMC TUSCALOOSA.GPJ TEMPLATE UPDATE 3-31-14.GPJ 11/14/14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E1145217 OUTPATIENT SERVICES EXPANSION VAMC TUSCALOOSA.GPJ TEMPLATE UPDATE 3-31-14.GPJ 11/14/14

BORING LOG NO. B-4

PROJECT: Outpatient Services Expansion VAMC Tuscaloosa

CLIENT: Toland Mizell Molnar

SITE: Tuscaloosa, Alabama

LOCATION See Exhibit A-2

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	**SILTY SAND, FILL**							
2.5	**LEAN CLAY, FILL**, trace sand, dark brown to red-brown			X	2-2-2 N=4	15		
5.0	**LEAN CLAY (CL)**, red-brown, soft	5		X	2-2-2 N=4			
10.0	**LEAN CLAY (CL)**, trace sand, red-brown, stiff	10		X	3-4-8 N=12			
				X	10-10-11 N=21			
14.0	**LEAN CLAY (CL)**, trace sand, red-brown to tan mottled, stiff							
23.5	**SANDY LEAN CLAY (CL)**, lighat red-brown to tan mottled, very stiff	15		X	3-7-9 N=16	17		
		20		X	6-8-9 N=17			
30.0	**POORLY-GRADED SAND (SP)**, light brown to tan, medium dense	25		X	6-5-6 N=11			
		30		X	5-5-6 N=11	10		18
	Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Backfilled with cuttings

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No water observed

Terracon
110 12th Street North
Birmingham, Alabama

Boring Started: 10/30/2014	Boring Completed: 10/30/2014
Drill Rig: Geoprobe	Driller: CTL
Project No.: E1145217	Exhibit: A-7

BORING LOG NO. B-5

PROJECT: Outpatient Services Expansion VAMC Tuscaloosa

CLIENT: Toland Mizell Molnar

SITE: Tuscaloosa, Alabama

LOCATION See Exhibit A-2

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**TOPSOIL**			X	3-8-7 N=15			
2.5	**LEAN CLAY, FILL**, red-brown to brown							
5.0	**LEAN CLAY (CL)**, trace sand, red-brown to brown, medium stiff			X	3-3-5 N=8	22		
13.5	**LEAN CLAY (CL)**, with sand, red-brown to tan mottled, very stiff	5		X	3-8-10 N=18			
		10		X	4-8-10 N=18			
18.5	**LEAN CLAY (CL)**, with sand, light red-brown to tan, very stiff	15		X	8-9-9 N=18			
23.5	**LEAN CLAY (CL)**, trace sand, red-brown to gray mottled, very stiff	20		X	8-14-12 N=26	20		
30.0	**POORLY-GRADED SAND (SP)**, light brown to tan, medium dense	25		X	10-14-15 N=29			
		30		X	10-9-12 N=21			
	Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Backfilled with cuttings

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No water observed

Terracon
110 12th Street North
Birmingham, Alabama

Boring Started: 10/30/2014	Boring Completed: 10/30/2014
Drill Rig: Geoprobe	Driller: CTL
Project No.: E1145217	Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E1145217 OUTPATIENT SERVICES EXPANSION VAMC TUSCALOOSA.GPJ TEMPLATE UPDATE 3-31-14.GPJ 11/14/14

BORING LOG NO. B-6

PROJECT: Outpatient Services Expansion VAMC Tuscaloosa

CLIENT: Toland Mizell Molnar

SITE:
Tuscaloosa, Alabama

LOCATION See Exhibit A-2

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	**TOPSOIL**							
2.5	**LEAN CLAY, FILL**, red-brown to brown			X	3-7-8 N=15			
	LEAN CLAY (CL), red-brown to tan mottled, stiff			X	9-6-4 N=10			
	becomes very stiff	5		X	6-9-13 N=22	19		
12.0		10		X	9-8-12 N=20			
	SANDY LEAN CLAY (CL), light red-brown to tan, very stiff	15		X	11-10-11 N=21			
23.0	becomes hard	20		X	10-15-15 N=30			
	POORLY-GRADED SAND (SP), light brown to tan, medium dense	25		X	10-8-7 N=15	9		
30.0		30		X	10-9-9 N=18			

Boring Terminated at 30 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Backfilled with cuttings

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

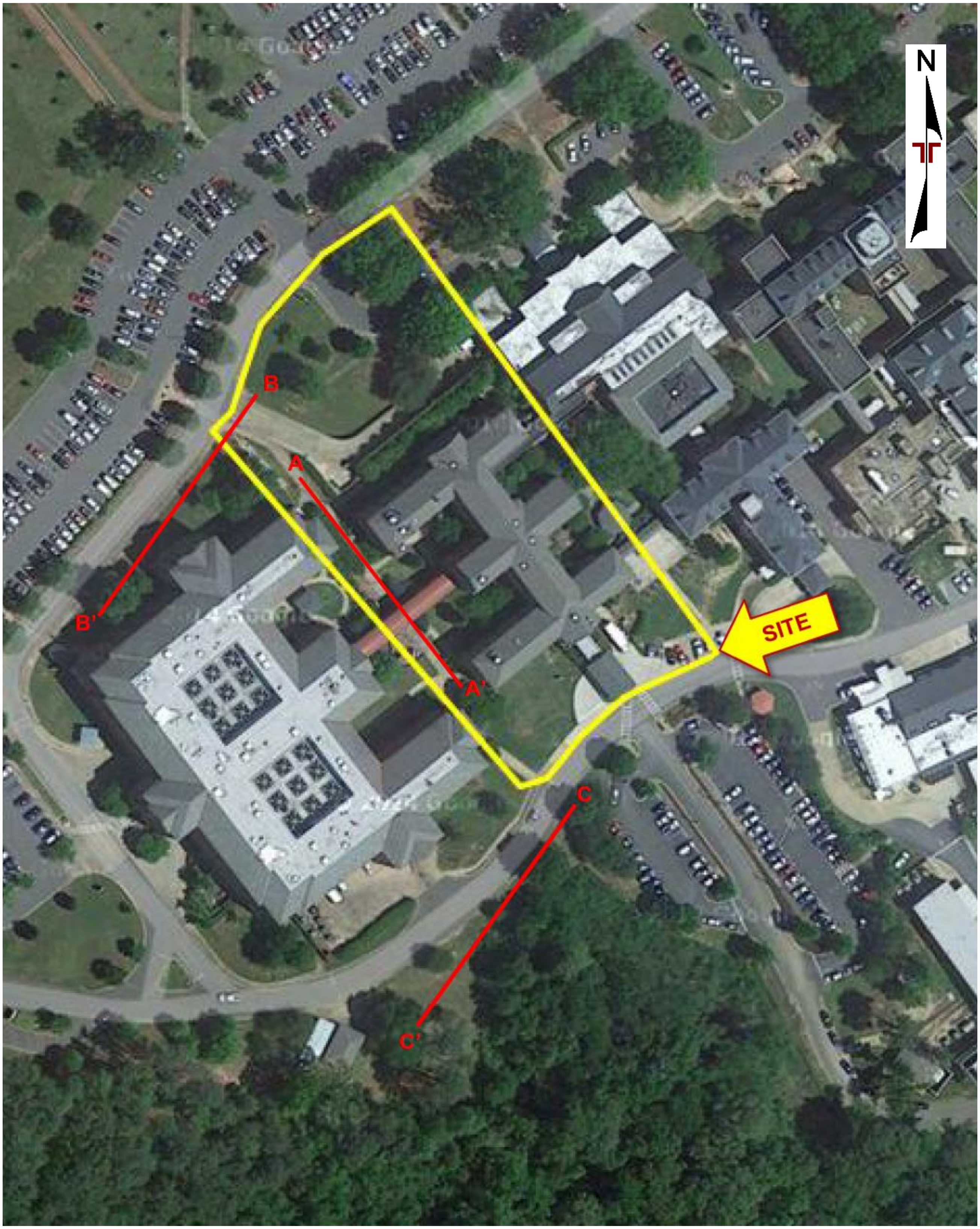
Notes:

WATER LEVEL OBSERVATIONS
No water observed

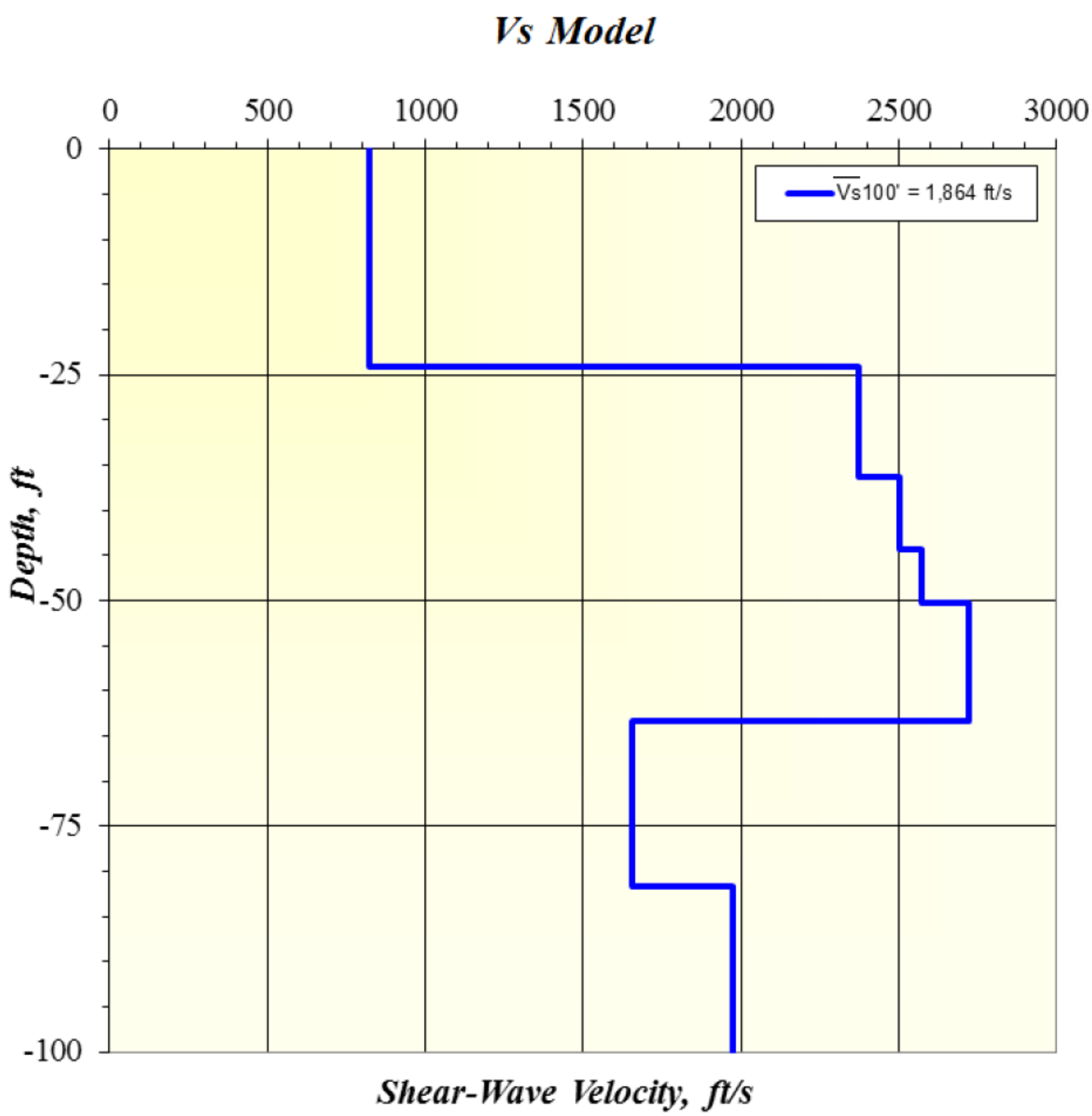
Terracon
110 12th Street North
Birmingham, Alabama

Boring Started: 10/30/2014	Boring Completed: 10/30/2014
Drill Rig: Geoprobe	Driller: CTL
Project No.: E1145217	Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E1145217 OUTPATIENT SERVICES EXPANSION VAMC TUSCALOOSA.GPJ TEMPLATE UPDATE 3-31-14.GPJ 11/14/14



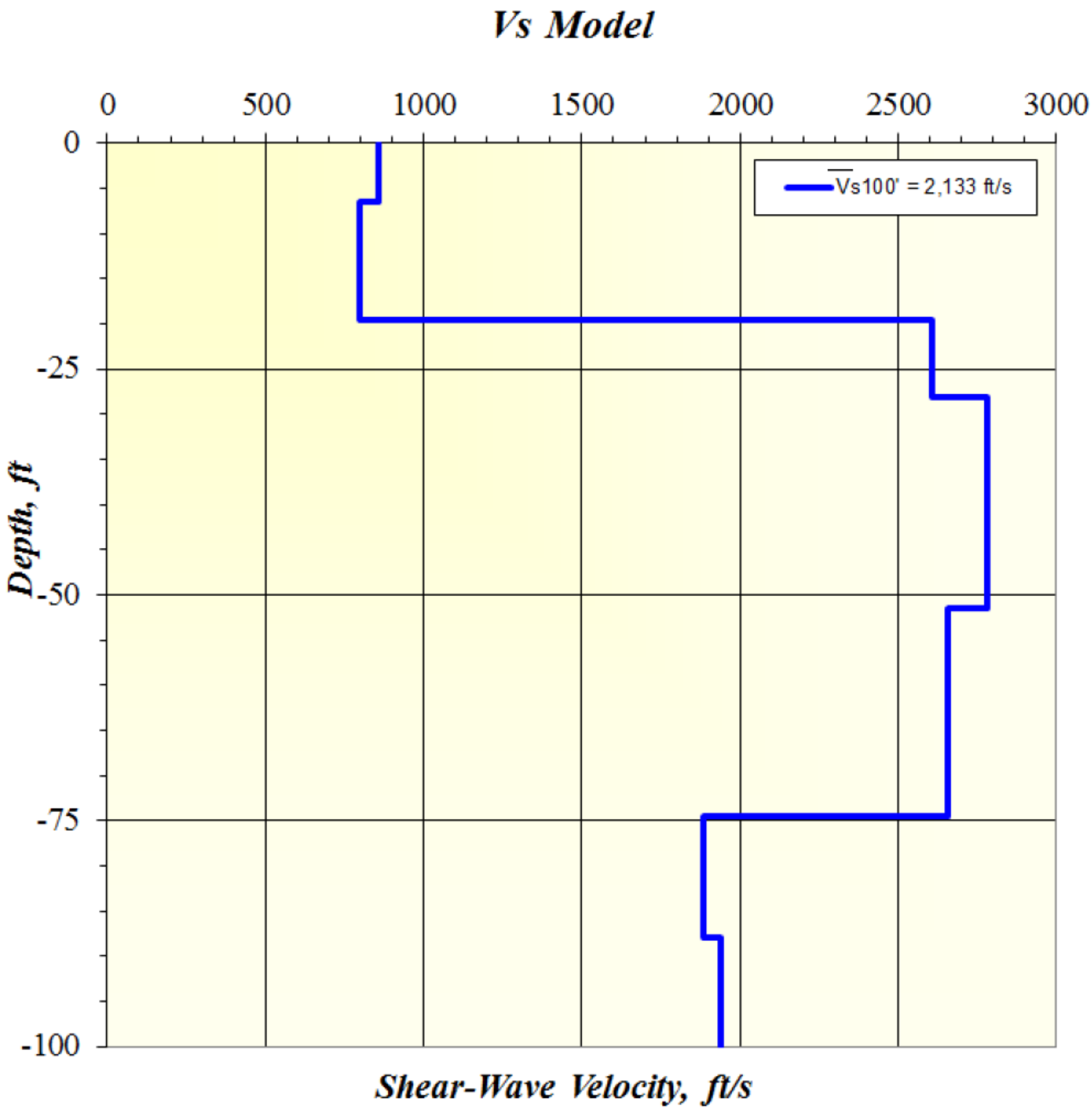
Project Manager: SWW	Project No. E1145217	Terracon Consulting Engineers & Scientists	Seismic Array Location Map	EXHIBIT
Drawn by: SWW	Scale: NTS	110 12th Street North, Birmingham, Alabama 35203	Outpatient Services Expansion	A-10
Checked by: CLR	File Name: E1145217 BLP	PH. (205) 942-1289 FAX. (205) 443-5302	VAMC – Tuscaloosa	
Approved by: CLR	Date: 10/27/2014		Tuscaloosa, Alabama	



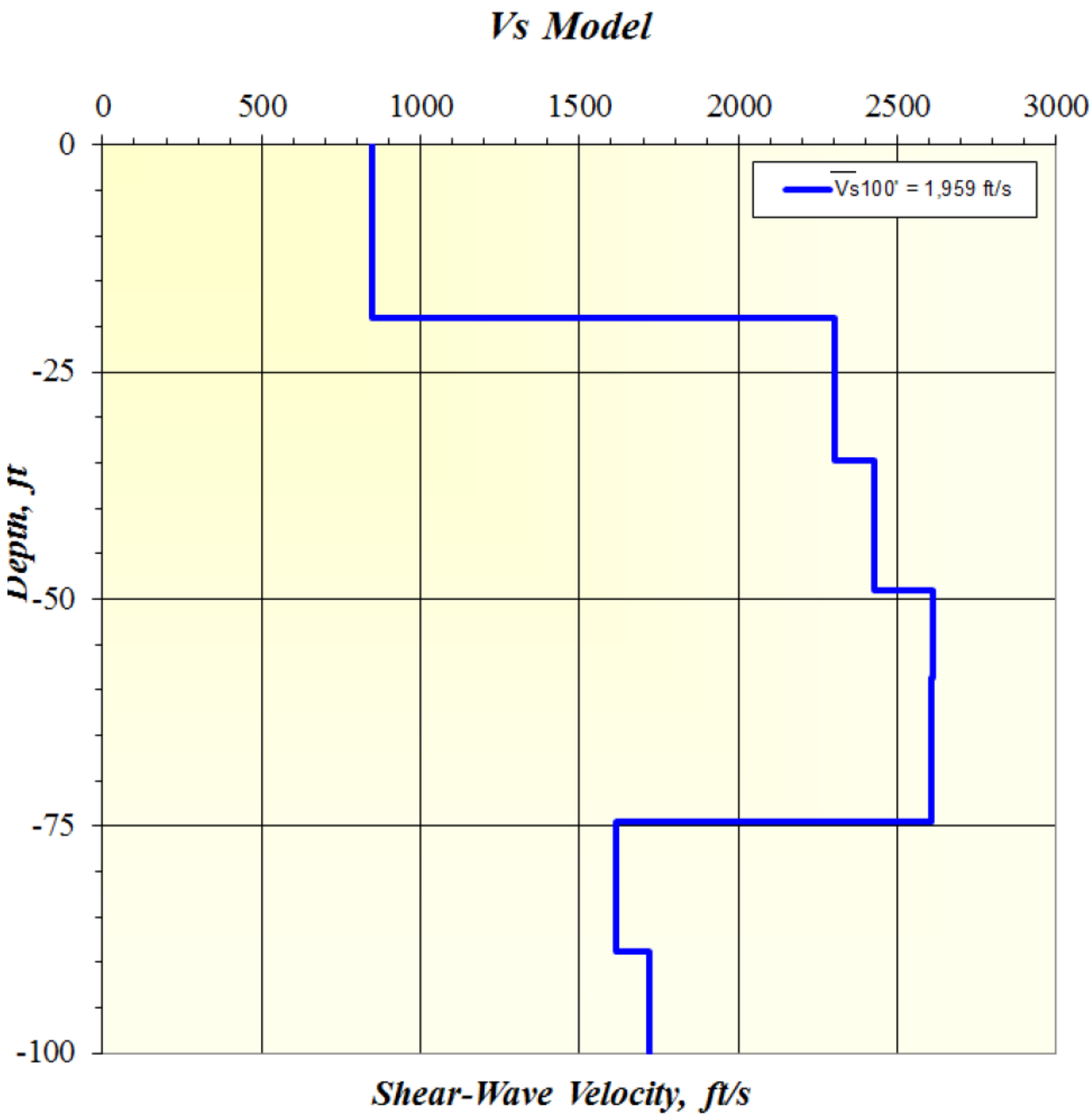
Project Manager: SWW	Project No. E1145217	Terracon Consulting Engineers & Scientists	Shear Wave Velocity Profile A-A’
Drawn by: SWW	Scale: NTS	110 12th Street North Birmingham, Alabama 35203	Outpatient Services Expansion
Checked by: CLR	File Name: E1145217 BLP	PH. (205) 942-1289 FAX. (205) 443-5302	VAMC – Tuscaloosa
Approved by: CLR	Date: 10/27/2014		Tuscaloosa, Alabama

EXHIBIT

A-11



Project Manager: SWW	**Project No.** E1145217	Terracon Consulting Engineers & Scientists	Shear Wave Velocity Profile B-B'	EXHIBIT
Drawn by: SWW	**Scale:** NTS	110 12th Street North Birmingham, Alabama 35203	Outpatient Services Expansion VAMC – Tuscaloosa Tuscaloosa, Alabama	A-12
Checked by: CLR	**File Name:** E1145217 BLP	PH. (205) 942-1289 FAX. (205) 443-5302		
Approved by: CLR	**Date:** 10/27/2014			



Project Manager: SWW	Project No. E1145217	Terracon Consulting Engineers & Scientists	Shear Wave Velocity Profile C-C'	EXHIBIT
Drawn by: SWW	Scale: NTS	110 12th Street North Birmingham, Alabama 35203	Outpatient Services Expansion	A-13
Checked by: CLR	File Name: E1145217 BLP	PH. (205) 942-1289 FAX. (205) 443-5302	VAMC – Tuscaloosa	
Approved by: CLR	Date: 10/27/2014		Tuscaloosa, Alabama	

APPENDIX B

LABORATORY TESTING

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS). At that time, the field descriptions were confirmed or modified as necessary. Laboratory testing was accomplished to determine index properties, such as moisture content and Atterberg limits.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. All classification was by visual manual procedures.

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING		
	Auger	Split Spoon
	Shelby Tube	Macro Core
	Ring Sampler	Rock Core
	Grab Sample	No Recovery

WATER LEVEL	
	Water Initially Encountered
	Water Level After a Specified Period of Time
	Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS	
(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	**Group Name** [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.